

# RESEARCH HIGHLIGHTS

Technical Series

01-133

## LOWER COST ALTERNATIVE FOR MUNICIPAL SEWER INSPECTION AND MAINTENANCE

### Introduction

*Lower Cost Alternative for Municipal Sewer Inspection and Maintenance* is a research report commissioned by Canada Mortgage and Housing Corporation (CMHC) to investigate various options for sewer line access.

Manholes are an integral part of sewer systems. They provide entry access to maintenance personnel, a junction for multiple pipe connections, access for flow monitoring and sewer sampling, and ventilation. There are operation and maintenance problems associated with manholes. Settlement in the pavement around manholes can create hazards for motorists, bicyclists and pedestrians, and require continuous maintenance. Repair or replacing manholes in a boulevard is disruptive and costly. Groundwater can seep into the sanitary sewer system through cracks or joints in the manhole. This additional infiltration and inflow can increase the cost of sewage treatment, harm the environment and contribute to basement flooding.

The purpose of the study is to help reduce the problems associated with the standard manhole and to reduce subdivision servicing costs by introducing an economical, efficient, technically sound and innovative structure to replace the standard manhole, yet maintain ease in operation and maintenance.

### Research Program

#### Methodology

The researchers conducted an extensive investigation and analysis of various configuration options, construction materials and methods, structural stability and hydraulic performance. The study was done in two phases. The first one consisted of the development of alternate sewer line access models and the evaluation of the most favourable option. The second phase included constructing a field model and monitoring the amount of settlement around the top of the access, debris accumulation, frequency of cleaning required and structural integrity of the facility. With this information, the researchers were able to quantify potential savings in operation and maintenance costs.

During the first phase, three sewer line access options were developed. Their evaluation included construction details, materials, hydraulic performance, operation and maintenance, and comparison with a standard manhole. To develop the sewer line access options, the researchers gathered information from various municipalities, manufacturers and sewer maintenance corporations. They contacted 34 municipalities in a number of provinces to obtain information on sewer line access options,

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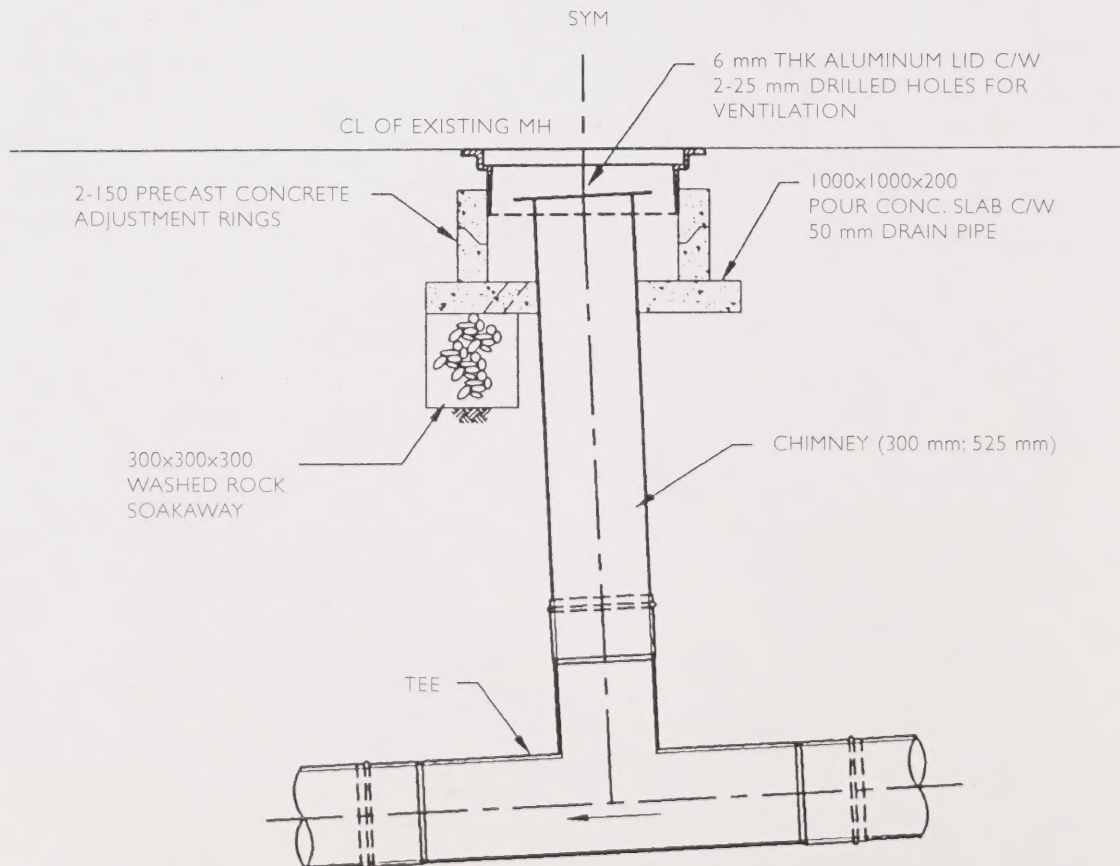


and 12 responded. They also conducted a literature review to identify various engineering publications containing topics that address alternate sewer line access. Based on the information obtained from the various sources, the researchers established design criteria for the sewer line access options and three models for evaluation. Option 1 required two accesses: one for the entry of video inspection and cleaning equipment, and the other for the return of the equipment. Option 2 required a single entry with a double wye at the upper section of the chimney to provide entry and return access for video inspection and cleaning equipment. Option 3 had a single entry and used a tee that provides adequate space for video inspection, cleaning and rehabilitation equipment to enter the sewer system.

## Findings

Of the three sewer line access options evaluated, the most favourable was Option 3 (single entry and an oversize standard tee). For this option, the chimney should be constructed with a piece of straight pipe having a diameter equal to the sewer main or 300 mm minimum to accommodate video inspection and cleaning equipment. The tee could be a standard or a prefabricated fitting. A prefabricated tee, should have a smooth turning radius rather than the usual tee configuration with a sharp 90° turn. However, due to difficulties in construction, the smooth curve was replaced with a straight section.

**Figure 1: Conceptual design of option “3”**





Option 3 was the most cost-effective alternative. It was the easiest to build and the best at minimizing or eliminating surface runoff and infiltration. It also allowed the installation of an access cover at any location by rotating the chimney.

The materials favoured for the construction of the sewer line access are polyvinyl chloride (PVC), ultra rib polyvinyl chloride and reinforced concrete pipe and fittings. The manhole frame and cover currently in use for conventional manholes could also be used for the sewer line access, with preferably the floating type. The PVC and concrete sewer line access could be connected to various types of sewer pipe with flexible rubber coupling manufactured by Power Seal Pipeline Products Corporation and others.

Other findings outlined in the report include the construction methods including bedding, alignment and backfill, and connection to existing sewers. Construction cost estimates are also included as well as cost estimates for sewer mains of 200, 250, 300, 375 and 450 mm.

The report also details the cost saving for an alternative sewer line access by using a typical subdivision in Edmonton. The subdivision is about 6 hectares and consists of 88 lots with surface areas of approximately 468 m<sup>2</sup>. The construction costs for five manholes as standard manholes with alternative sewer line access are \$20,033.00 standard manholes; \$11,874.00 for the PVC ultra rib pipes and fittings; and \$13,135.00 for the PVC pipes and fittings.

The cost saving in using a PVC ultra rib and a PVC sewer line access, while not dramatic for a small scale development, would be more significant for a larger development. They are provided in the following table:

## Conclusions

The study shows that an alternative PVC sewer line access would be a feasible and cost-effective replacement for standard manholes. The merits of the proposed alternative sewer line access are the following:

- more economical than conventional systems;
- easier and quicker to construct than conventional systems;
- minimizes or eliminates surface runoff infiltration; and
- the manhole covers can be located off the pavement.

While the proposed system would not completely replace all standard manholes, it could be used at junctions of two straight-run pipes in a sanitary sewer system. In addition, it would be suitable only at junctions where flow monitoring is not conducted and for sewer lines 450 mm or smaller in diameter. The fact that this system could not be used for flow monitoring should not offset its many merits. With the proposed system, flow monitoring would take place only in a few manholes in strategic locations in a watershed.

This alternative system would be easily accessible by all sewer video and inspection and cleaning equipment, and provide proper ventilation for the sewer. Its chimney would have a smaller diameter than a standard manhole and be constructed from a full length of pipe with fewer joints to allow infiltration. Surface runoff would drain into a gravel soakaway and not into the sewer system.

In the typical subdivision used for illustration purposes, the saving in construction costs in a sanitary sewer system compared to conventional manholes was approximately \$1,150 per hectare. Therefore, in a large development,

Description	Cost Saving			
	PVC (\$)	% Over Standard MH	PVC Ultra Rib (\$)	% Over Standard MH
Entire Subdivision	6,898	34	8,159	41
Per Lot	78	34	93	41
Per Hectare	1,150	34	1,360	41

the overall cost saving would be quite significant. The savings would be even greater for those municipalities in Ontario where catch basin leads are connected directly into storm sewers, making it possible to install the alternative sewer line access in a storm sewer system.

The PVC ultra rib pipe and fittings is the most economical material for constructing an alternative access line less than 300 mm in diameter. However, the authors recommend the use PVC pipe and fittings because of their greater acceptance by municipalities.

The authors recommend that phase 2 of the research (the construction and evaluation of a field model) be undertaken to evaluate its performance and assess the potential savings in operation and management costs. These costs would include two video camera inspections every six months and a visual inspection of the settlement around the access.

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#### **Housing Research at CMHC**

Under Part IX of the *National Housing Act*, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This fact sheet is one of a series intended to inform you of the nature and scope of CMHC's research.

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